EXHIBIT 5

Expert Report of Bruce E. Koenig

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LABORATORY REPORT

September 13, 2024

To: Emma Freudenberger, Esq.
Neufeld Scheck Brustin Hoffmann & Freudenberger, LLP
200 Varick Street, Suite 800
New York, NY 10014

Re: Termaine Hicks v. City of Philadelphia, et al.

Laboratory Number: 2407240

Specimens downloaded: July 24, 2024

Q10A One PDF file named "Begault - ExhibitC_rule26report.pdf".
Q10D One PDF file named "NE1_AES122_Scream.pdf".
Q10E One PDF file named "NE2_SneddonPearsonsFidell.pdf".
Q10F One PDF file named "NE3_fidell-1978-humanfactors.pdf".
Q10G One PDF file named "NE4_AEDT3d_TechManual.pdf".

Specimen received: September 10, 2024

Q11 One PDF file named "Errata_rule26report_8.29.pdf", which is a two-page letter from Durand R. Begault to Attorney Joseph Zaffarese, dated August 29, 2024.

Specimens received: September 11, 2024

Q12 One ZIP file named "Matlab Scripts.zip".
Q13 One XLSX file named "Data Analysis_HICKS.xlsx".

Results of the review of the above specimens:

1. The specimen Q10A document titled "Begault - ExhibitC_rule26report.pdf" [hereafter the "Begault Report"] reflects, in part, on page 4:
   "***Signal used to represent a female scream***
   Reference NE1 provides laboratory measurements of female screaming from ten exemplar subjects at a distance of 3 feet. The average level of a scream starts at 107 decibels, falling to 102 decibels or less midway through the scream, due to a reduction in vocal power during exhalation. The victim was 39 years old at the time of the incident; the range of subjects in reference ***NE1*** *was mid-20s to mid-40s, with the highest levels for persons under 30 years of age.*"
   BEK TEK LLC Response:
   a. The referenced specimen Q10D NE1 research paper titled "NE1_AES122_Scream.pdf" does not contain a statement that "[t]he average level of a scream starts at 107 decibels, falling to 102 decibels or less midway through the scream, due to a reduction in vocal power during exhalation." Instead, the paper states on the first page that "[i]n rank order, the data can be summarized for each participant in order from most to least intense: 123, 122, 122, 118, 115, 110, 109, 109, 108 and 102 decibels [dBs]. The average level is 113.8 dB, and the standard deviation is 7.3 dB. The values reported are the maximum A-weighted level using a fast (.125 ms) time integration ($L_{AF\text{-}MAX}$) to correspond to human perception." Therefore, the basis for this statement is not listed in the NE1 paper.
   b. You cannot determine the effects of age on the amplitude of female screams, based on this research, since only ten (10) subjects, in total, were analyzed.

2. The Begault Report reflects, in part, on page 5: "*It was impractical to use actual recordings of screaming for the tests. A recording of a police siren in wail mode was used as a proxy signal, at three different successive levels, corresponding to the average scream level reported in* ***NE1****: 107, 102 and 95 decibels, to simulate the reduction in a human scream level over time. The siren has its primary energy in frequencies similar to a typical scream, around 1.5 kHz.*"
   BEK TEK LLC Response:
   a. A police siren does not sound like a female scream. The left Figure 4 on page 5 of the Begault Report reflects that the siren sound had a peak energy between approximately 700 and 1600 hertz (Hz), whereas the second page of the referenced NE1 paper reflects that there are energy peaks at approximately 1300 to 1700 Hz, 2700 to 3200 Hz, 4000 to 4700 Hz, and 5400 to 6200 Hz for the female scream; additionally, the single siren peak has a different shaping than the four peaks for the female scream. Therefore, the siren sound is appreciably different than the female screams.
   b. The NE1 paper reflects in its Summary that "[a] scream is similar to a baby's cry; there is nearly a universally-understood agreement as to its meaning regarding human calamity, and its frequency content seems almost tailored to

frequencies of maximal sensitivity on an equal-loudness contour. The level at which a scream might be discriminated from other types of sounds in most contexts is likely not much higher than the level at which it can be detected, due to its unique character." Therefore, according to Dr. Begault's own article, a human scream is not similar to a siren sound and it can be easily differentiated and detected from other sounds, even when the level of the scream is "not much higher" than the surrounding noise (that is, with a low signal-to-noise ratio).

c. As noted above, the NE1 paper does not contain a statement that "[t]he average level of a scream starts at 107 decibels, falling to 102 decibels or less midway through the scream, due to a reduction in vocal power during exhalation." Therefore, the basis for this statement is not listed in the NE1 paper.

d. The maximum values for the female screams are included in the NE1 paper, which range from 123 to 102 dB, with an average level of 113.8 dB. Therefore, the testing should have ranged from 123 to 102 dB, instead of the overall lower values of 107 to 95 dB; this would have produced appreciably louder test results and, therefore, different conclusions in the Begault Report. For example, if the average dB level for a female scream of 114 dB had been used instead of 107 dB, based on Dr. Begault's own calculations, the D'L value would have been approximately 21.1 instead of 14.1 (i.e., "noticeable 80-95% of the time").

3. The Begault Report reflects, in part, on page 5: "*A primary difference from a scream is that the siren maintains a constant level (unless is it* [sic] *adjusted in steps, as done here) whereas a scream gets progressively quieter. Another difference is that a police siren is unvarying in its character, whereas there can be significant differences within or between different scream sounds from one person, or between different persons. Finally, the loudspeaker remained in a fixed position during each test, whereas a victim would be moving. The use of a siren signal would therefore maximize audibility observed in the measurements, compared to an actual scream.*"

BEK TEK LLC Response:

a. The Begault Report does not provide any research or other basis reflecting that a constant level sound is more audible than a varying signal.

b. The Begault Report does not provide any research or other basis reflecting that a signal with an unvarying character is more audible than a varying signal.

c. A fixed position does not necessarily provide more audibility, since a person can move his/her head or body to provide a better positioning to hear the sound.

d. The NE1 paper reflects in its Summary that "[a] scream is similar to a baby's cry; there is nearly a universally-understood agreement as to its meaning regarding human calamity, and its frequency content seems almost tailored to frequencies of maximal sensitivity on an equal-loudness contour. The level at which a scream might be discriminated from other types of sounds in most contexts is likely not much higher than the level at which it can be detected, due to its unique character." Therefore, according to Dr. Begault's own article, a human scream is not similar to a siren sound and it can be easily differentiated and detected from other sounds, even when the level of the scream is "not much higher" than the surrounding noise (that is, a low signal-to-noise ratio).

4. The Begault Report reflects, in part, on page 5: "*References **NE2-NE4** include calculation methods for including the level of background ambient noise to calculate the likelihood of noticeability of a signal, using a metric called D'L ('d-prime level'). If there is sufficient signal level relative to noise in a recording of a signal, D'L can be calculated from the 1/3 octave band spectra measurements of the signal and noise. Essentially, a signal is considered to be noticeable 80-95% of the time when D'L is equal to16-30 (roughly, a signal that is 8-22 decibels higher in level than background noise).*"

   BEK TEK LLC Response:

   a. The research paper specimen Q10E NE2 reflects, in part, on page 300 that the subjects were "reading self-selected newspapers, magazines, or similar light material [and] were instructed to click a mouse on a screen icon when they noticed a sound that they found notable, annoying, or otherwise would rather not have heard." BEK TEK LLC has not been provided with any information that the listener in this case was reading during the event. If the listener was not reading during the event, then this research is of marginal value, at best, in supporting the results of the Begault Report.

   b. The research paper specimen Q10E NE2 reflects, in part, on page 304 that "[s]etting a criterion for noticeability of signals of this type clearly requires a definition of the hit rate of a 'noticeable' signal. The transition band between 50% and 95% notice of signals (23–11=12 dB) is considerably wider than the corresponding band (6.0-3.6=2.4 dB) for attentive signal detection. The increased width of the transition may well reflect variations in attentiveness to the primary reading task of the study." Therefore, noticeability is affected if the listener is reading at the time of the event. BEK TEK LLC has not been provided with any information that the listener in this case was reading during the event. If the listener was not reading during the event, then this research is of marginal value, at best, in supporting the results of the Begault Report.

   c. The research paper specimen Q10E NE2 reflects, in part, on page 301 that the five signals "presented to test subjects were a large civil transport jet landing, a large jet bomber low-altitude flyby, a commercial truck drive-by, a mid-sized automobile drive-by, and a three-car commuter train passby." None of these signal sources sound like or are at all technically comparable to a female screaming; therefore, this research is of marginal value, at best, in supporting the results of the Begault Report.

   d. The research paper specimen Q10F NE3 reflects, in part, on page 19 that "[t]wenty-four subjects engaged in a simulated driving task detected audible warning signals of the sort commonly used by emergency vehicles. The simulated driving task, carried out in an instrumented car under computer control, including steering toward alternately illuminated fender lights and maintaining a constant speedometer reading. The required detection response was depression of the brake pedal." Therefore, this research paper is not comparable to a listener of a female scream, since the subjects in this research were engaged in vehicle driving tasks and were detecting "four actual emergency vehicle warning signals and two synthetic signals" [third page], versus an individual hearing sounds without being physically active. Therefore, this

research is also of marginal value, at best, in supporting the results of the Begault Report.

e. The research paper specimen Q10G NE4 reflects, in part, on pages 7 and 228, the background information on detectability and audibility regarding individuals who are "actively listening for aircraft noise". There is no research information listed regarding the analysis of females screaming in an urban environment; therefore, this research does not appear to be applicable to supporting the results of the Begault Report; at best, it is of marginal value.

f. Based on the above, these referenced papers are measuring entirely different scenarios for both the type of sound and the actions of the listener, which means the statement that "[e]ssentially, a signal is considered to be noticeable 80-95% of the time when D'L is equal to 16-30 (roughly, a signal that is 8-22 decibels higher in level than background noise)" is not applicable for supporting the female screaming event in this case.

5. The Begault Report reflects, in part, on page 6: "*The ambient level during the measurements ranged from ~47–63 decibels, depending on traffic on nearby roads, or people talking in the vicinity of the recording.*"

BEK TEK LLC Response:

a. The above ambient level range was measured in April 2024, but BEK TEK LLC has been advised that the event in question occurred in November 2001, or approximately 23 years earlier. The Begault Report does not comment on the effects of increased population, traffic noise, new or removed buildings, and so forth, for the area where the event occurred. If the ambient noise was lower in 2001, then the scream would have been louder and more noticeable to the listener. The Begault Report also does not comment on the effects of the time of year, as it is very likely the ambient noise at approximately 5:00 am in November is less than in April.

b. As noted above, the Begault Report uses ambient levels of "~47–63 decibels", which are from 2024 and most likely do not represent the 2001 conditions, and a noticeability requirement of "8-22 decibels higher in level than background noise", which is based on research papers with completely different signals than a female screaming and are thus not applicable.

c. As noted above, the Begault Report tested the source levels at "107, 102 and 95 decibels", based on a reference to a paper that does not list those values for female screamers. If the tests had been performed at the maximum levels found in the same paper, namely 123 to 102 dBASPL, the results would have been different. The 107, 102 and 95 dB levels at 860 feet would attenuate to 57.9, 52.9 and 45.9 dB, whereas the 123 to 102 dB levels would attenuate from 73.9 to 52.9. Therefore, for example, the 123 dB amplitude would be 16 dB louder than the 107 dB level used in the Begault Report, which would make the scream completely audible and noticeable, based on the Begault Report.

6. The specimen Q13 document named "Data Analysis_HICKS.xlsx" reflects in the "X4 loudest" spreadsheet that the computed detectability (d') value for rows 16 through 19 is "25.9" and the detectability level (D'L) is "14.1".

BEK TEK LLC Response:

a. The following formulas provided in Appendix A of the Begault Report were used for the calculations of the d' and D'L values by BEK TEK LLC:

$$d' = \eta \sqrt{\sum_{i=1}^{N} \Delta f_i \left(\frac{s_i}{n_i} \right)^4}$$

D'L = 10 $\log_{10}$ (d')

b. The computed values for detectability (d') and detectability level (D'L) have been inaccurately calculated by Dr. Begault. The d' value is actually 50.3 and the D'L value is actually 17.0. Exhibit A provides a detailed explanation of the errors introduced by Dr. Begault and the improper order of operations he followed in his calculations.

c. As noted above, the Begault Report reflects, in part, on page 5: "*Essentially, a signal is considered to be noticeable 80-95% of the time when D'L is equal to16-30 (roughly, a signal that is 8-22 decibels higher in level than background noise).*" Since Exhibit A reflects the errors and improper order of operations that Dr. Begault used to incorrectly find a D'L value of 14.1 in his spreadsheet, the corrected value of 17.0 places the results in the "*noticeable 80-95%*" range, based on his report.

d. Moreover, if Dr. Begault had tested the screams at 114 to 123 dB, the corrected d' and D'L values would have been significantly higher.

The signal analysis reviews of the above specimens were conducted by Bruce E. Koenig, whose curriculum vitae is attached as Exhibit B. BEK TEK LLC is being compensated at the rate of US$320.00 per hour, plus for any actual expenses.

I hereby declare under penalty of perjury and pursuant to 28 U.S.C. § 1746 that the forgoing statements are true and correct.

Respectfully submitted,

Bruce E. Koenig

September 13. 2024
Date

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EXHIBIT A

Laboratory Number 2407240

Termaine Hicks v. City of Philadelphia, et al.

Dr. Begault's Errors in Calculating d'_{total} and $D'L_{total}$ Values for "X4 loudest"

Dr. Begault's Errors in Calculating d'_{total} and $D'L_{total}$ Values for "X4 loudest"

In calculating the $\mathbf{d'}_{total}$ and $\mathbf{D'L}_{total}$ values for "X4 loudest", Dr. Begault did not follow the proper mathematical order of operations and made several errors in his intermediate calculations.

He first calculated individual $\mathbf{D'L}_{band}$ values for 4 scenarios in "X4 loudest", using a modified version of the equation stated in "APPENDIX A" of his report. In his modified version, Dr. Begault split the elements within the square root into two separate square roots: the square root of the bandwidth (Δf) and the square root of the ratio of s (signal) to n (noise) raised to the 4th power. The square root of a value X raised to the 4th power is that value squared (X^2). However, Dr. Begault incorrectly included the s/n ratio in his revised equation without it being squared. It appears, however, that he attempted to account for this by squaring his derived $\mathbf{d'}_{band}$ values later in column O [$\mathbf{(d'}_{band}\mathbf{)^2}$], but this was in error. Based on Dr. Begault's modified version of the original equation, the squaring only applies to the s/n ratio and not to the bandwidth (Δf) nor the efficiency factor (η), both of which are already factored into his derived $\mathbf{d'}_{band}$ values. By squaring the derived $\mathbf{d'}_{band}$ values, he introduced mathematical errors which carry through into further calculations which rely on these values.

After incorrectly calculating these individual $\mathbf{d'}_{band}$ and $\mathbf{(d'}_{band}\mathbf{)^2}$ values, Dr. Begault then added the $\mathbf{(d'}_{band}\mathbf{)^2}$ values together, seemingly to account for the summation (Σ) element of the original equation in "APPENDIX A" of his report. However, employing the summation function at this stage is incorrect. The summation applies only to the product of the bandwidth (Δf) and the s/n ratio raised to the 4th power for each given scenario before the square root function is applied to the total sum. The result of the square root of the total sum is then multiplied by the efficiency factor (η), which is "assumed to be 0.4 for a human observer" according to Dr. Begault's report. Summing the individual $\mathbf{(d'}_{band}\mathbf{)^2}$ values (already in error as discussed above) at the back end as Dr. Begault has done is incorrect and further compounds the errors in his final $\mathbf{d'}_{total}$ and $\mathbf{D'L}_{total}$ values.

The proper mathematical order of operations for the calculation of $\mathbf{d'}_{total}$ (as given in "APPENDIX A" of Dr. Begault's report) is as follows:

- Calculate the s/n ratio for scenario 1 and raise it to the 4th power.
- Multiply the result by the bandwidth (Δf) for scenario 1.
- Temporarily hold that value.
- Calculate the s/n ratio for scenario 2 and raise it to the 4th power
- Multiply the result by the bandwidth (Δf) for scenario 2.
- Add this result to the result held for scenario 1.
- Repeat the process for scenario 2 with the remaining scenarios, each time adding the result to the running total.

- Take the square root of the final running total.
- Multiply the result by the efficiency factor (***η***) (0.4 as given by Dr. Begault in his report).

Then, to calculate the corresponding **D'L*total*** value, calculate the $\log_{10}$ of **d'*total*** and multiply the result by 10.

When the errors above are avoided and the proper mathematical order of operations is followed for the 4 scenarios of "X4 loudest", the **d'*total*** value comes out to be 50.3. Because the efficiency values given for the 4 scenarios in Dr. Begault's revised "X4 loudest" spreadsheet are now not all equal to 0.4 (they range from 0.402 to 0.441), an average value of 0.426 was calculated and used in place of 0.4 for the corrected the **d'*total*** calculation. The corresponding **D'L*total*** value comes out to be 17.0, not 14.1 as calculated by Dr. Begault in the revised "X4 loudest" spreadsheet.

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EXHIBIT B

Laboratory Number 2407240

Termaine Hicks v. City of Philadelphia, et al.

Curriculum Vitae for Bruce E. Koenig

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CURRICULUM VITAE OF BRUCE E. KOENIG

Professional Positions

1996-Present Private consultant, examiner, researcher, and founder of the forensic, audio/video/image consulting company BEK TEK LLC. Conducts forensic examinations of audio, video and still image media, both analog and digital, to: authenticate, improve intelligibility, visually enhance, identify/classify voice and non-voice signals, change playback speeds, and evaluate certain voice comparison techniques; identify acoustical/visual gunshot events, their timing, location, grouping by weapon, and amplitude; analyze digital images to authenticate, enhance quality and review metadata information; extract video frames as separate image files, which can be cropped, enlarged, and analyzed; measure certain objects in images; provide on-site evaluations of gunshot and other acoustical sounds plus speech; prepare transcriptions; present expert testimony and assist attorneys in preparing for cross-examination of opposing experts and lay witnesses; evaluate certain recording and analysis equipment; conduct research regarding forensic applications.

1996-2003 Hired as a forensic scientist for the Federal Bureau of Investigation (FBI), to conduct examinations of audio and video recordings in addition to continuing the forensic training of FBI employees.

1974-1995 Supervisory Special Agent, Engineering Section, FBI, Washington, D.C., Newington, VA, and Quantico, VA. Conducted examinations of audio and video recordings, both analog and digital, produced or collected by Federal, state, local, and foreign law enforcement and judicial agencies; and the supervision of forensic technicians, engineers and projects. These forensic analyses included authentication of recordings, intelligibility enhancement, voice comparisons, identification/classification of voice and non-voice signals, and other related examinations. Additional duties included analyses of room acoustics; on-site evaluations of sound pressure levels, gunshot events, and other sounds of interest; testing of audio tapes, digital and analog recorders, and laboratory analysis equipment and software; the presentation of expert testimony in criminal, civil, and administrative matters; training of FBI and other law enforcement personnel in forensic audio analysis; and conducting appropriate research. At retirement, was the manager and senior audio examiner of the FBI's Audio/Video Signal Processing program, which was composed of approximately 30 individuals, including Ph.D scientists, electrical & electronic engineers, other supervisory special agents, non-agent examiners, and support staff. At that time, this was the largest laboratory group dedicated to the analyses of forensic audio and video examinations in the world.

1970-1974 Special Agent, FBI. Investigative responsibilities in the Atlanta and Detroit Divisions involving bank robberies, prison escapes, terrorism, and other violations of Federal law. Also was the technical coordinator of the photographic laboratory in the Detroit FBI Division.

Formal Education

Bachelor of Science degree, University of Maryland, majors of Physics and Mathematics.

Certificate, DeVry Institute of Technology (now called DeVry University), electronics curriculum on the theory and circuitry design of audio and video components, including recorders, radios, and stereo equipment, with an emphasis on televisions and the associated video signal.

Master's degree, George Washington University, major of Forensic Science.

Additional graduate level courses at George Mason University, Massachusetts Institute of Technology, the University of Colorado Denver and the University of Utah.

Work Experience

Has conducted examinations on over 21,000 separate audio and video recordings, and still images, in over 6200 criminal, civil, and administrative matters, including over 3700 authenticity analyses, the enhancement of over 10,000 recordings and still images, over 6600 signal analysis determinations, over 12,000 additional analyses, and over 2200 voice comparison examinations. Submissions have been received from clients in private and governmental organizations from all 50 states within the United States of America, the Commonwealth of the Northern Mariana Islands, the District of Columbia, Guam, Puerto Rico, the U.S. Virgin Islands (both St. Croix and St. Thomas), Argentina, Australia, Canada, Cayman Islands, Colombia, Costa Rica, Croatia, Denmark, El Salvador, Ecuador, England, Eritrea, Germany, Grenada, Hong Kong, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Kenya, Mexico, the Netherlands, New Zealand, Nicaragua, Northern Ireland, Panama, Philippines, Romania, Singapore, South Korea, Switzerland, Turkey, Turks and Caicos Islands, Ukraine, and Venezuela.

Has instructed numerous personnel in the FBI, other Federal agencies, state, local, and foreign law enforcement departments, and private consultants in forensic analysis procedures.

On hundreds of occasions has lectured and presented papers before scientific, forensic, investigative and legal organizations regarding forensic examinations.

Regularly peer-reviews scientific/technical articles, presentations, books, and doctoral theses in the audio/video signal processing fields.

Affiliate/Associate of the Audio Forensics Group, Organization of Scientific Area Committees, National Institute of Standards and Technology (NIST), U.S. Department of Commerce (2015).

Member of the Ad Hoc Subcommittee on “The 18½-Minute Erased Portion of Nixon White House Tape 342,” Advisory Committee on Preservation, National Archives and Records Administration (2000).

While chairperson of the Voice Identification and Acoustical Analysis Subcommittee, of the International Association for Identification, was responsible for writing and having approved the first comprehensive standards on spectrographic voice identification, outside the FBI (effective January 1, 1992).

FBI's project manager to the National Research Council, National Academy of Sciences, for their evaluation of spectrographic voice identification, titled "On the Theory and Practice of Voice Identification" (1979).

Assisted the members of the National Research Council, National Academy of Sciences' Committee on Ballistics Acoustics, in the examination of the acoustic information in the assassination of President John F. Kennedy (late 1970s).

Clients, since establishing BEK TEK LLC, have included the U.S. Department of Justice; Federal Bureau of Investigation; U.S. Congress; Office of Independent Counsel, Bureau of Alcohol, Tobacco, Firearms and Explosives; Drug Enforcement Administration; Security and Exchange Commission; U.S. Department of Defense; U.S. Department of Energy; U.S. Customs Service; Federal Trade Commission; United Nations Criminal Tribunal; National Academy of Sciences; U.S. Agency for International Development; district attorney’s offices; public defender’s offices; police departments; prosecuting attorney’s offices; law school legal clinics; ombudsmen; sheriff’s departments; state attorney general’s offices; bar associations; city & county attorney’s offices; governmental judicial conduct committees; private investigators; universities/colleges; the news media; private law firms; insurance companies; major corporations; utilities; labor unions; magazine editors; and small businesses.

Work Experience (continued)

Has conducted forensic examinations in numerous significant investigations, including: the authenticity analysis of the Linda Tripp telephone recordings involving the investigation of President William J. Clinton; the authenticity and enhancement of audio and video recordings in the HBO documentary series "The Jinx: The Life and Crimes of Robert Durst", including his bathroom comment of "Killed them all, of course"; the enhancement, enlargement, magnification, speed changes, and looping of the Cobb Theater videos of Curtis Reeves, a retired Tampa, FL, police captain, fatally shooting Chad Oulson; the digital recordings of test gunshot sounds outside the Marjory Stoneman Douglas High School in Parkland, FL, and their laboratory analysis to determine their amplitude levels compared to the ambient noise at the site (this was the location of the 2018 shootings in which 17 people, including 14 students, were killed); the former the authenticity analysis of the telephone recordings concerning Housing and Urban Development Secretary Henry G. Cisneros; the enhancement examination of President Richard M. Nixon's White House recordings, including the "Watergate tapes"; the gunshot analyses in the assassination of President John F. Kennedy and the attempted assassination of Ronald W. Reagan; the authenticity and enhancement analyses of the undercover informant's recordings in the Archer Daniels Midland antitrust cases; the video surveillance analyses in the murder of Odin Lloyd, in which former New England Patriots player Aaron Hernandez was convicted; the enhancement of the Len Bias 911 recording when he is dying of a cocaine overdose (he was a first-team, All-American college basketball forward at the University of Maryland); the enhancement of the audio recording of the torture and killing of DEA Agent Enrique "Kiki" Camarena by drug lord Rafael Caro Quintero; the authenticity and enhancement examinations in the John Gotti and other high-profile organized crime cases; the authenticity determination and identification of gunshot sounds on audio and video tapes involved in the burning of the Branch Davidian complex in Waco, Texas; the analysis of the six gunshot sounds and the voices recorded by the cockpit area microphone (CAM) of the Pacific Southwest Airlines flight 1771 before it crashed; the analysis of voices and background sounds in the Atlanta Child Murders case; the authenticity and voice comparison analyses of audio recordings involved in three criminal trials before the United Nations Criminal Tribunal for the former Republic of Yugoslavia; the intelligibility determination and transcript preparation of U.S. government recordings in the Sabrina Aisenberg kidnapping investigation; the video authenticity analyses involved in the investigation by the U.S. Congress of presidential campaign financing in the Clinton administration; the authenticity examination of digital audio recordings from the office of Ukrainian President Leonid Kuchma; the analog tape authenticity analysis in the comedian William H. Cosby, Jr. criminal rape case; the authenticity examination of the FBI's undercover analog and digital recordings in the $2.7 billion fraud prosecution of Richard M. Scrushy, former CEO of HealthSouth Corporation; the analysis of the gunshots fired by members of the Ku Klux Klan, the American Nazi Party, the Communist Workers Party, and the Socialist Workers Party during a "Death to the Klan" demonstration in Greensboro, NC; the authenticity analysis of audio microcassette recordings in the Canadian Prime Minister Stephen Harper vs. The Liberal Party of Canada civil case; the authenticity analysis of 35 digital audio recordings in the conspiracy and interception of wire communications prosecution in the U.S. vs. Anthony Pellicano and Terry Christensen case; the digital authenticity analyses in the Libananco Holding Co. v. Republic of Turkey civil matter resolved by a World Bank Tribunal; the gunshot examinations in the deaths of Timothy Russell and Malissa Williams by the Cleveland Police Department, in which over 130 shots were fired; the authenticity and enhancement of air traffic control recordings involved in the destruction of Korean Airlines Flight 007 by a Russian missile; many espionage cases and other major airplane crashes since the late 1970s; many capital punishment/death penalty cases; the audio and image enhancement analyses plus transcription preparation in the Duke University Lacrosse Team case; the signal analysis examination of the engine, rotor and electrical system sounds of the Sikorsky helicopter crash near Weaverville, CA resulting in the death of seven firefighters, the pilot and the safety officer.

Specialized Short Courses Attended (partial listing)

Acoustics and Electroacoustic Measurement, presented by Brüel & Kjær, in Marietta, GA

Applications of Modern Image Processing Systems, presented by The International Society for Optical Engineering, Bellingham, WA

Autopsy [computer software] Basics and Hands On, presented by Basis Technology Corp., Cambridge, MA

Cellular Telephone System, presented by Douglas A. Kerr, in Dallas, TX

Computer Science Technology, University of Utah, Salt Lake City, UT

Digital Signal Analysis for Applications in Sound and Vibration, presented by Pope Engineering Company and Brüel & Kjær, in Norcross, GA

Electroacoustic Measurements on Telephones, presented by Brüel & Kjær, in Marietta, GA

Essentials of Industrial Security Management, presented by the Army Institute for Professional Development, Fort Eustis, VA

Eyes Wide Open: New Insights into Digital Video Forensics (regarding file structures in image and video authenticity analyses), presented by National White Collar Crime Center (NW3C), Richmond, VA

FFmpeg (Fast Forward Moving Picture Experts Group) for Forensic Video Examinations Webinar, presented by Resolution Video Inc., Fredericksburg, VA.

Fast Fourier Analysis, presented by Spectral Dynamics, in San Diego, CA

FBI Laboratory Quality Assurance Training on Evidence Submission, Examination, and Return, presented by the FBI Laboratory Division, Quantico, VA

File Systems Revealed, presented by X-Ways Software Technology AG, in Seattle, WA

Forensic Authentication of Digital Audio, presented by the National Center for Media Forensics, University of Colorado, Denver, CO

Forensic Authentication of Digital Images, presented by the National Center for Media Forensics, University of Colorado, Denver, CO

Image and Video Processing Using MATLAB, presented by MathWorks, in Vienna, VA

Image Processing and Analysis, presented by The International Society for Optical Engineering, Bellingham, WA

Mastering Analog Video Technology, presented by The Sony Video Institute, in San Jose, CA

Mastering Digital Video Technology, presented by the Sony Training Institute, in San Jose, CA

Mastering Telecommunications Fundamentals, presented by Two Rivers Technologies, in Washington, D.C.

Specialized Short Courses Attended (partial listing - continued)

Medex Examiner Video Authentication & Source Identification Training, presented by Medex Forensics, Madison, WI. Then passed the Medex Certified Media Examiner (MCME) examination and certified as Medex Certified Media Examiner.

Presenting Data and Information, presented by Edward R. Tufte, in Arlington, VA

Professional Photography, presented by New York Institute of Photography, New York, NY

Selected Topics in Acoustics, presented by George Mason University, Fairfax, VA

Signal and Image Processing and Analysis for Scientists and Engineers, presented by Applied Technology Institute, Laurel, MD

Sonic Boom: Prediction and Effects, presented by American Institute of Aeronautics and Astronautics, in Tallahassee, FL

Speech Enhancement, presented by The University of Utah, Salt Lake City, UT

Speech Spectrogram Reading: An Acoustic Study of English Words and Sentences, presented by the Massachusetts Institute of Technology. Cambridge, MA

Video Analyst System Training, presented by Intergraph, Huntsville, AL

Video Capture, Enhancement and Analysis, presented by The Institute for Forensic Imaging (in association with Indiana University and Purdue University), Indianapolis, IN

Voice Identification, presented by Voice Identification, Inc., in Manville, NJ

X-Ways Forensics, presented by X-Ways Software Technology AG, in Seattle, WA

Testimony

Has testified as an expert in the fields of audio/video/image analyses in judicial proceedings, including trials, hearings, and depositions on over 430 occasions on cases from: The Netherlands, Northern Ireland, Singapore, South Korea, Turks and Caicos Islands, District of Columbia, Guam, Puerto Rico, U.S. Virgin Islands, Alabama, Alaska, Arizona, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, and West Virginia.

Seminars

Have attended numerous seminars, conventions, conferences, and workshops of organizations including the Acoustical Society of America, Audio Engineering Society, DSP Expo, International Association for Identification, International Society for Optical Engineering, Institute of Electrical and Electronic Engineers, International Speech Communication Association, National Association of Broadcasting, and National Technical Investigators Association.

Miscellaneous

Full-field, TOP SECRET and Sensitive Compartmented Information (SCI) clearances (1970-2004).

Reviewer/limited contributor for a number of legal papers and books, including the second and third editions of Scientific Evidence by Paul C. Giannelli and Edward J. Imwinkelried.

Photos of Mr. Koenig and his associate Artese Kelly are displayed in The Sixth Floor Museum at Dealey Plaza in the former Texas School Book Depository building, Dallas, Texas, regarding the Kennedy Assassination audio examinations conducted by the FBI.

First-hand account regarding some FBI experiences appears in the chapter entitled "Best Work in Law Enforcement" in the book *Guide to Careers in the FBI*, 2nd edition by John Douglas, published in 2005 by Simon & Schuster.

Professional Society Memberships

Acoustical Society of America – member. Member of the Subcommittee on Forensic Acoustics.

Audio Engineering Society – member. Member of the Audio Forensics Technical Committee and the Standards Working Group. Awarded the 33rd "2015 Distinguished Richard C. Heyser Memorial Lecturer" at the 139th Audio Engineering Society Convention in New York City, with a presentation entitled "Acoustic Forensic Gunshot Analysis — The Kennedy Assassination and Beyond."

International Association for Identification – Distinguished and Life Active member. Member of the Editorial Board for the *Journal of Forensic Identification*. Former chairperson of both the Voice Identification and the Acoustical Analysis Subcommittees plus the Voice Identification Certification Board; former board member of the Forensic Video Analysis Certification Study Committee.

Institute of Electrical and Electronic Engineers (IEEE) – Life Senior member. Member of the IEEE Signal Processing Society.

National Technical Investigators Association – former member.

Society of Former Special Agents of the Federal Bureau of Investigation – member.

Society of Motion Picture and Television Engineers (SMPTE) – Life Member.

SPIE [formerly known as The International Society for Optical Engineering] – former member (2000-2010).

Scientific Publications

Koenig, Bruce E.; Lacey, Douglas S. Effects of Content Trimming iPhone 12 Pro Max Video Files in iOS 14. *Journal of Forensic Sciences* **2021**, 66, pp 1742-1750.

Koenig, Bruce E.; Lacey, Douglas S. Forensic Authenticity Analyses of the Metadata in Re-Encoded M4A iPhone iOS 12.1.2 Voice Memos Files. *2019 Audio Engineering Society International Conference on Audio Forensics: Trust Powered by Science,* Porto, Portugal, **2019**.

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Koenig, Bruce E.; Lacey, Douglas S. Forensic Authenticity Analyses of the Metadata in Re-Encoded WAV Files. *The Proceedings of the AES 54th International Conference - Audio Forensics: Techniques, Technologies and Practice*, London, UK, **2014**, pp 77-84.

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Koenig, Bruce E.; Lacey, Douglas S. Forensic Authenticity Analyses of the Header Data in Re-Encoded WMA Files from Small Olympus Audio Recorders. *Journal of the Audio Engineering Society* **2012**, 60(4), pp 255-265.

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Koenig, Bruce E.; Lacey, Douglas S. An Inconclusive Digital Audio Authenticity Examination: A Unique Case. *Journal of Forensic Sciences* **2012**, 57(1), pp 239-245.

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RECENT EXPERT TESTIMONY OF BRUCE E. KOENIG

Number	Date	City	State	P**	Court	Judge	Court#	Defendant or Case	Exam*
435	08/29/24	West Palm Beach	FL	CVT	Circuit	Luis Delgado	2023CA00124MBAG	Jolicoeur v. Alexander	IA;VM
434	05/22/24	West Palm Beach	FL	HRG	Circuit	Scott I. Suskauer	2020CF001353BMB	Bonelly Miguel Fernandez	SA;VM;VE
433	05/08/24	New Haven	CT	DEP	Fed Dist	Charles S. Haight, Jr.	3:22-cv-00630	Stefon v. New Haven, etal.	AAU
432	04/05/24	West Palm Beach	FL	DEP	Circuit	Luis Delgado	2023CA00124MBAG	Jolicoeur v. Alexander	IA;VM
431	02/07/24	West Palm Beach	FL	DEP	Circuit	Luis Delgado	2023CA00124MBAG	Jolicoeur v. Alexander	IA;VM
430	08/18/23	West Palm Beach	FL	DEP	Circuit	Scott I. Suskauer	2020CF001353BMB	Bonelly Miguel Fernandez	SA;VM;VE
429	07/20/23	Fort Lauderdale	FL	HRG	Circuit	Carol-Lisa Phillips	CACE19080000	Marjory S. Douglas H.S.	SA
428	05/02/23	Ocala	FL	HRG	Circuit	Lisa Herndon	19-CF-3931	Michael McDermott	VAU
427	04/19/22	Atlanta	GA	HRG	Superior	Henry M. Newkirk	2019CV320855	McGahan v. McGahan	VAU
426	03/31/22	Nashville	TN	DEP	Fed Dist	Waverly D. Crenshaw, Jr.	3:20-cv-946	Layton v. Southerland	AAU
425	2/21-22/22	Dade City	FL	CRT	Circuit	Susan G. Barthle	2014-CF-216-AX-ES	Curtis Judson Reeves	VE;VM
424	02/17/22	Tampa	FL	CRT	Circuit	Samantha L. Ward	2019-CF-014704	Melissa Rose Turner	AM
423	02/08/22	Tampa	FL	HRG	Circuit	Christine A. Marlewski	2019-CF-014704	Melissa Rose Turner	AM
422	12/17/21	Dade City	FL	HRG	Circuit	Kemba Johnson Lewis	2014-CF-216-AX-ES	Curtis Judson Reeves	VM
421	10/01/21	Bartow	FL	HRG	Circuit	Keith P. Spoto	2021CF003623	Michael Shane Denn II	VAU;VM
420	08/31/21	Bartow	FL	HRG	Circuit	Keith P. Spoto	2021CF003623	Michael Shane Denn II	VAU;VM
419	08/02/21	Tampa	FL	DEP	Circuit	Scott A. Farr	2018CA001266	Salyer v Record Transcripts	AAU
418	06/15/21	Valparaiso	IN	CRT	Superior	Michael A. Fish	64D01-2005-MR-3704	John Salvadore Silva, II	AAU;AE
417	01/15/21	Dothan	AL	DEP	Fed Dist	R. Austin Huffaker, Jr.	2:15-cv-739	Massey v. Conner, et al	VM;SA
416	12/11/20	San Francisco	CA	DEP	Fed Dist	Donna M. Ryu	12-cv-1892	Maurice Caldwell v San Fran	AAU
415	11/30/20	Belfast, Northern Ireland		CRT	Crown	Justice O'Hara	14/126080	Duffy McCrory	AAU
414	10/15/20	Valparaiso	IN	CRT	Superior	Roger V. Bradford	64D01-1903-MR-2107	Connor Ralland Kerner	AAU;AE
413	08/20/20	Valparaiso	IN	HRG	Superior	Roger V. Bradford	64D01-1903-MR-2107	Connor Ralland Kerner	AAU;AE
412	02/24/20	Freehold	NJ	CVT	Superior	Andrea I. Marshall	MON-L-2468-14	Kelly v Charlie's Place	IAU
411	02/08/20	Seoul, South Korea		HRG	Int'l Court	3-Person Panel	23544/PTA	Mitsubishi Tanabe Corp vs	AAU
	02/11/20	Los Angeles	CA		of Arbitration			Kolon Life Science, Inc.	
410	09/16/19	Conway	SC	CRT	Circuit	R. Markley Dennis	2014-GS26-1125	Sidney Moorer	VM
409	07/24/19	Singapore		CVT	High Court	Chua Lee Ming	HC/5 772/2016	Prudential v Peter Tan Shou Yi	AAU
408	05/21/18	Portland	OR	HRG	Fed Dist	Robert E. Jones	3:17-cr-226-JO	W. Joseph Astarita	SA;VE;VM
407	03/29/18	New Haven	CT	DEP	Superior	Unassigned	NNH-CV15-6053275-5	Klein v. Quinnipiac Univ.	VM; IAU
406	3/6+21/18	Belfast, Northern Ireland		HRG	Crown	Justice Colton	14/126080	Harry Fitzsimmons, et al.	AAU; VC
405	07/06/17	West Hartford	CT	DEP	Superior	Cesar A. Noble	HHD-CV-16-6067801	Morant v Cramer, et al.	AAU
404	03/16/17	Mobile	AL	DEP	Circuit	J. Clark Stankoski	05-CV-2014-900812	Tuttle v Eastern Shore Lanes	VAU
403	02/21/17	Dade City	FL	HRG	Circuit	Susan G. Barthle	CRC-1400216CFAES	Curtis Judson Reeves	VE; VM

* Examination: AAU=Audio Authenticity; AE=Audio Enhancement; AM=Audio Misc.; AVAU=Audio/Video Authenticity; IA=Image Analysis; IAU=Image Authenticity; IE=Image Enhancement; SA=Signal Analysis; VAU=Video Authenticity; VC=Voice Comparison; VE=Video Enhancement; VM=Video Misc.

** Proceeding: CVT=Civil Trial; CTM=Court-Martial; CRT=Criminal Trial; DEP=Deposition; GRJ=Grand Jury; HRG=Hearing